2015 Aquatic Sciences Meeting
Aquatic Sciences: Global And Regional Perspectives — North Meets South
22-27 February 2015 — Granada, Spain
Sponsored by — Association for the Sciences of Limnology & Oceanography

ABSTRACT

VERTICAL VARIABILITY OF TROPHIC POSITIONS OF ZOOPLANKTON IN THE DEEP OCEAN

Zooplankton plays a key role in oceanic ecosystems. However, the trophic ecology of organisms in deep layers of the ocean is poorly known. In this study we analyze the variability of trophic positions of zooplankton collected across three ocean basins in the epi-, meso and bathypelagic domains. Stable carbon and nitrogen isotopes were used as indicators of the sources of nutrients and positions within the food web. The enrichment in heavy nitrogen isotopes with depth and the correlation between surface and deep samples revealed that deep zooplankton was supported by local epipelagic production, subsequently processed through the water column. In addition the nitrogen isotope enrichment of carnivores vs. omnivores was consistent across ocean biomes and water layers, suggesting a similar trophic structure of the pelagic food web in the deep ocean despite variations in the nitrogen sources. Siphonofora, Chaetognata and Myctophida were the top predators while Calanoid Copepods and Mysidacea displayed the lowest trophic positions. In contrast, carbon isotopes did not show significant variations with depth or trophic groups implying low influence of coastal production in deep ocean food webs.

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DETAILS

Oral presentation

Session #:008
Date: 2/26/2015
Time: 08:45
Location: Auditorium Manuel de Falla (Floor 1)

Presentation is given by student: No

Vertical variability of trophic positions of zooplankton in the deep ocean

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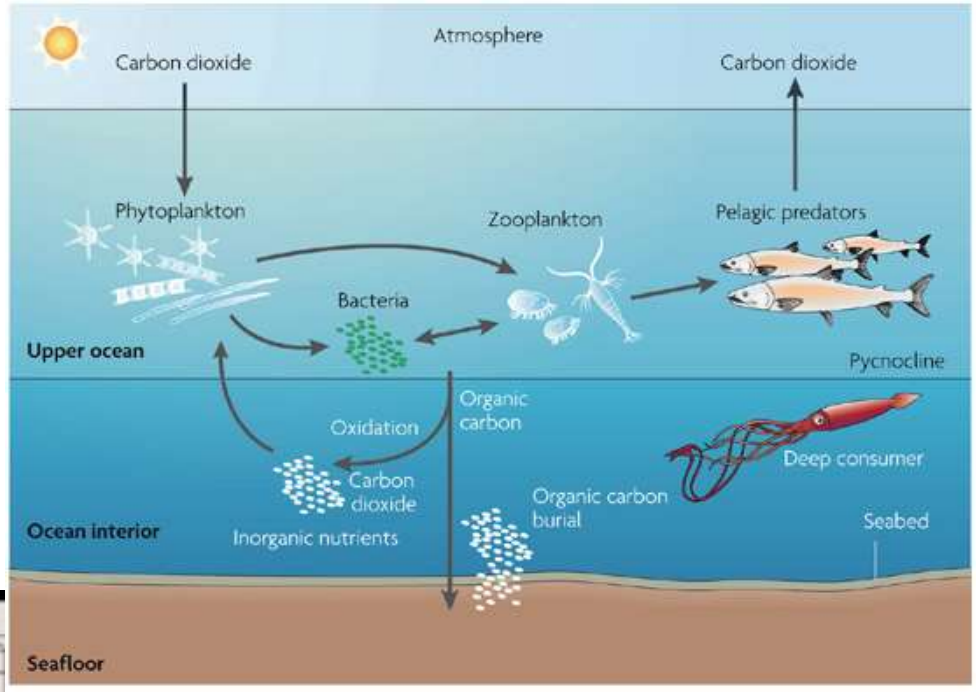
MALASPINA 2010

UN OCÉANO, UN FUTURO
I CENTENARIO
INSTITUTO ESPAÑOL DE OCEANOGRAFÍA

Deep ocean zooplankton:
A world of consumers

- Relies on surface production
- Mirrors (surface) nutrient inputs & sources
- Sustains deep ocean ecosystems
- A source of unknown diversity

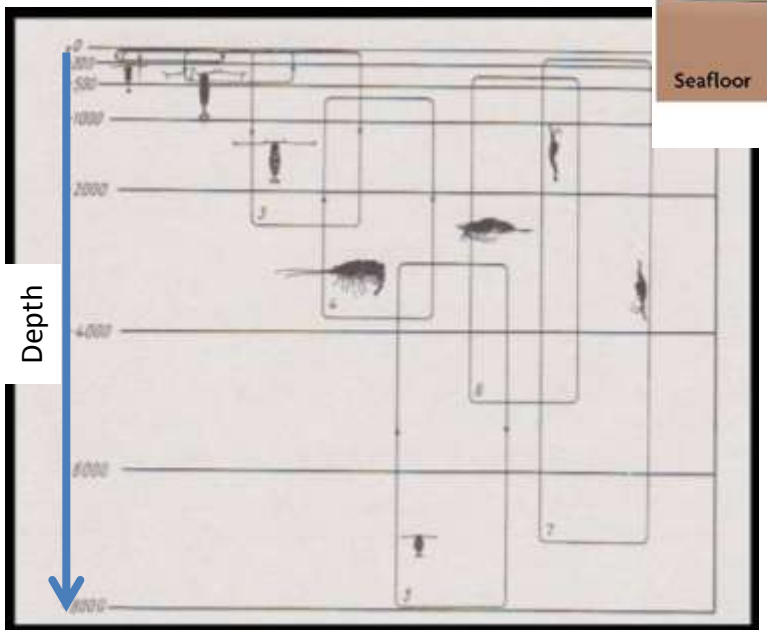
biological pump



Nature Reviews | Microbiology

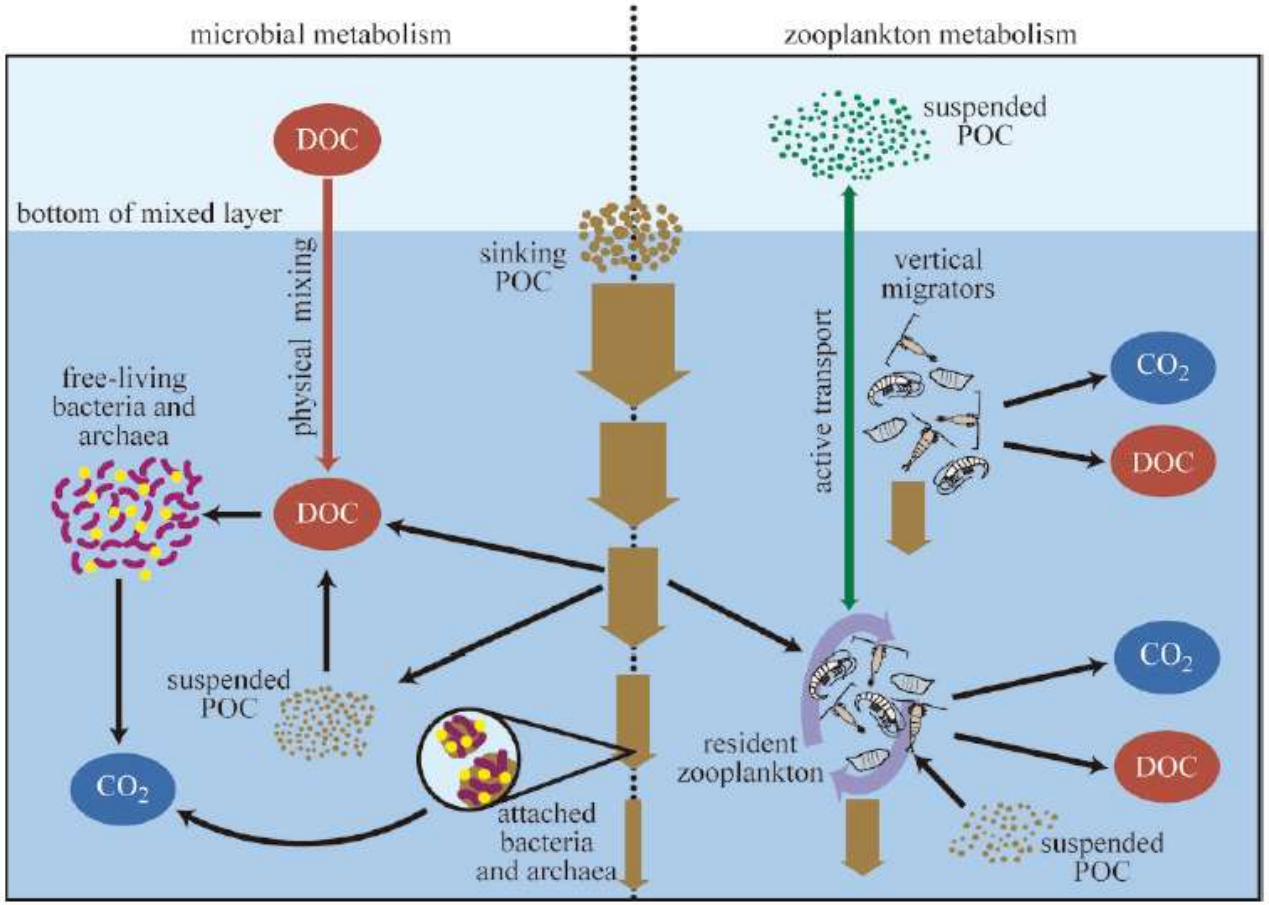
Falkowski & Oliver (2007)

migration ladder



Vinogradov (1970)

Microbes and zooplankton interact in OM degradation

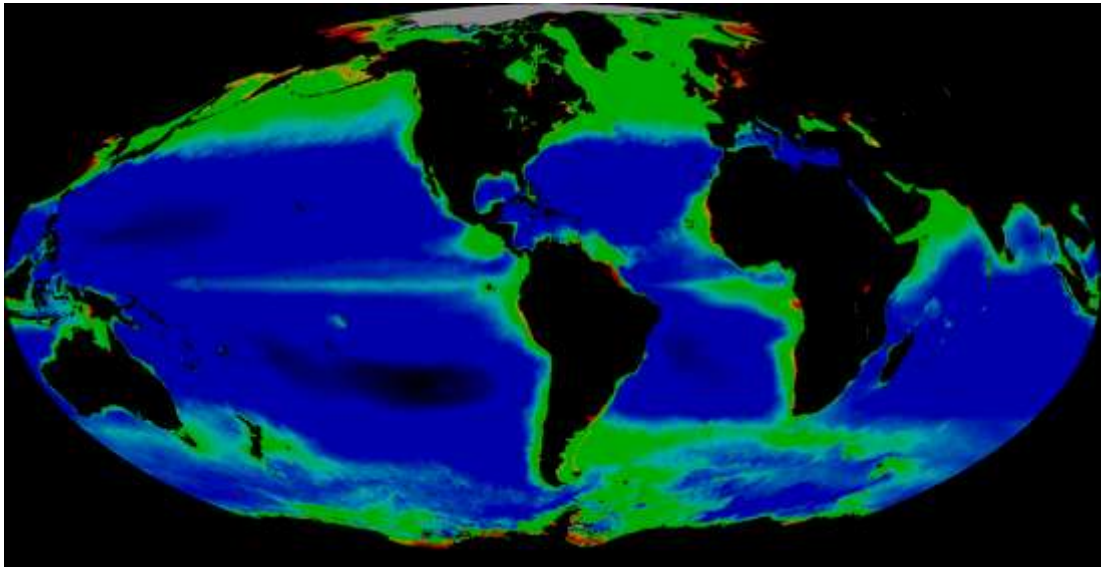


Steinberg et al. (2008)

Objective

Objective

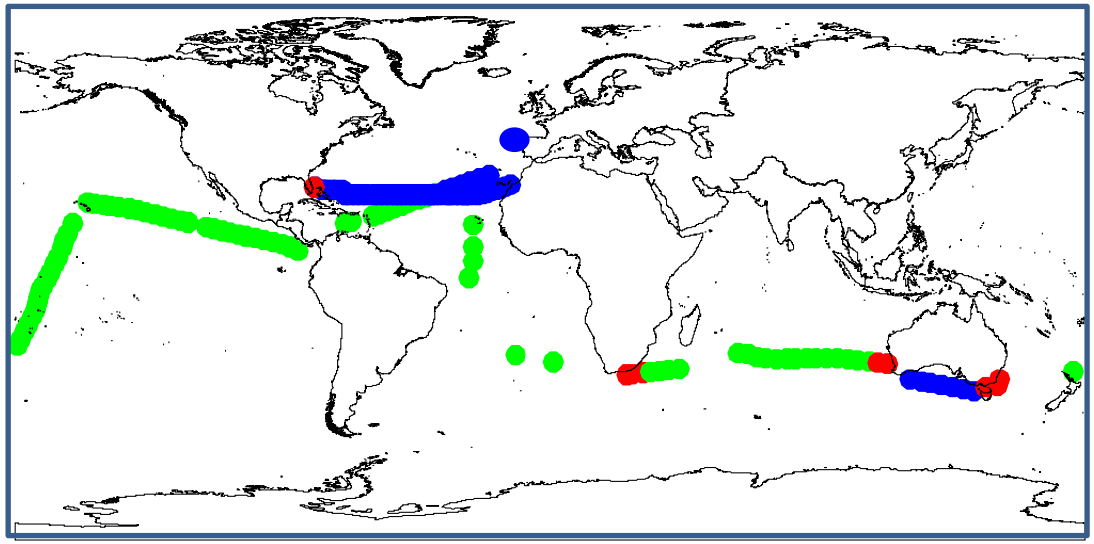
To detect patterns of change in trophic structure and nutrient sources in zooplankton across ocean regions and depth layers



NASA SeaWifs

Methods

Sampling:



Trades

Westerlies

Coastal

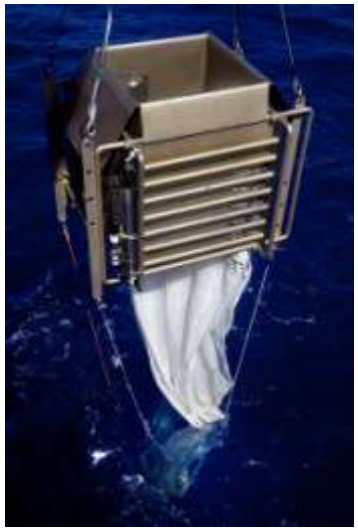
Cruises:

- Malaspina-2010 http://www.expedicionmalaspina.es/
- BIOPROF-0811 https://moduplansarmiento2014.wordpress.com/

Methods

Sample processing:

MULTINET (200 / 300 µm mesh; 5-8 layers, 0-4000 m)



Separation and
identification of specimens

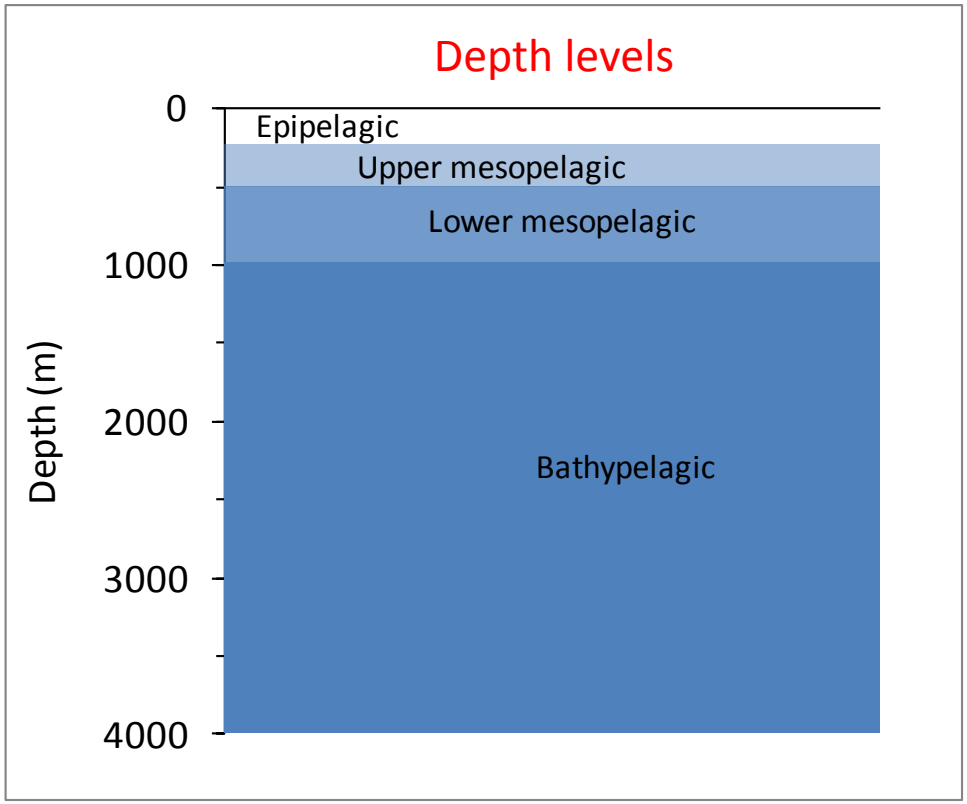
SINAR (mass-spectrometry)

$\delta^{15}N$ & $\delta^{13}C$ (‰)

WP2 net (40 µm mesh; 0-200 m)

Methods

Classification:



Trophic guilds

- Omnivores
- Carnivores

Taxonomic groups

Copepoda
Ostracoda
Chaetognatha
Decapoda
Euphausiacea
Siphonophora
Mysidacea
Amphipoda
Myctophydae

Methods

Taxonomic groups

- Copepoda
- Ostracoda
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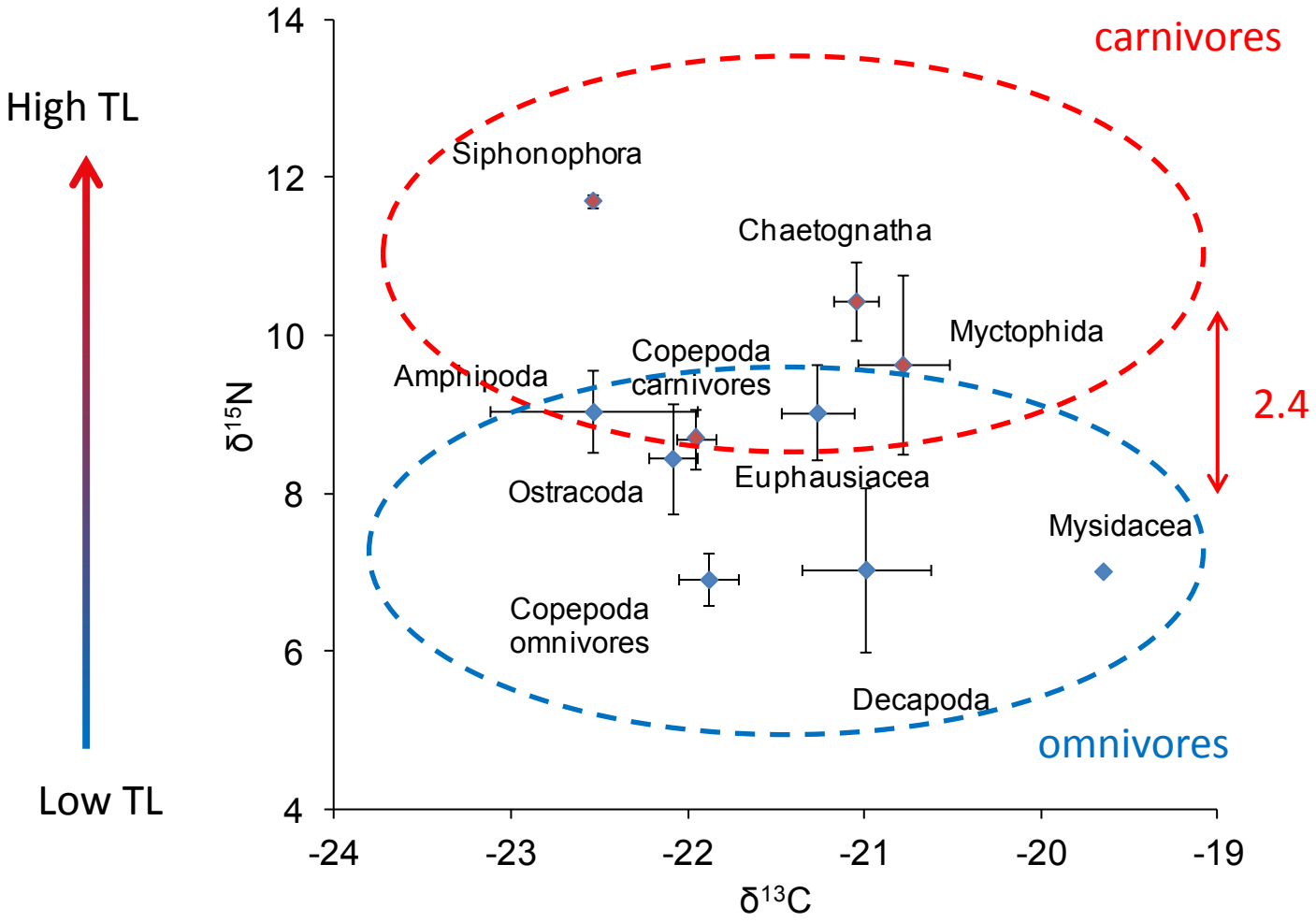
- Euphausiacea
- Siphonophora
- Mysidacea
- Amphipoda
- Myctophydae

carnivores

omnivores

Results

SINAR by groups and guilds:



Results

SINAR by biomes, depth layers and guilds:

factor	$\delta^{15}N$	$\delta^{13}C$
biome (3)	0.279	0.000
layer (4)	0.000	0.688
guild (2)	0.000	0.115
biome x layer	0.000	0.151
biome x guild	0.400	0.773
layer x guild	0.641	0.160
biome x layer x guild	0.260	0.964

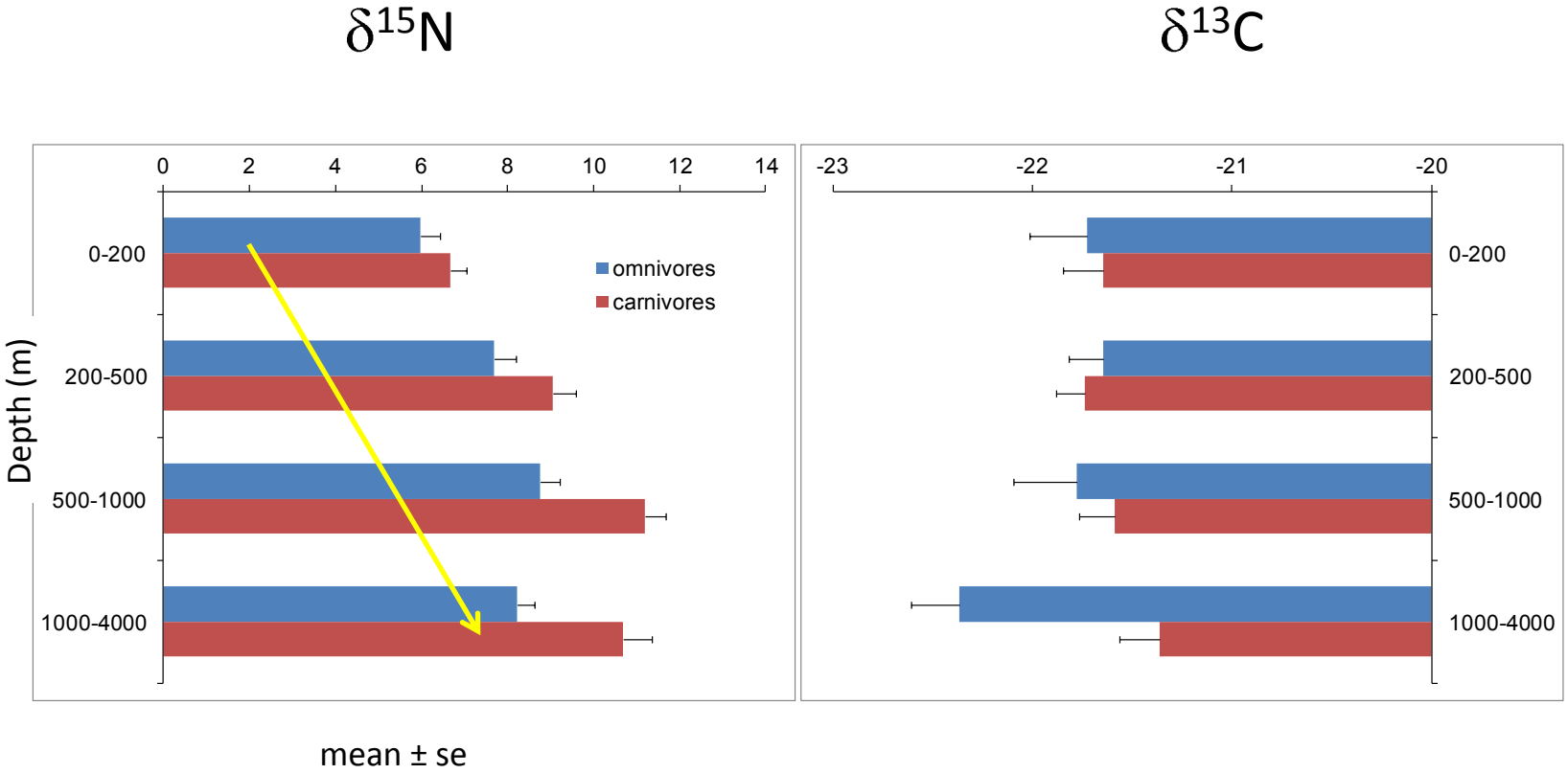
Stratified three-way ANOVA

means

biome	$\delta^{13}C$
Westerlies	-22.54
Trades	-21.41
Coastal	-21.74

Results

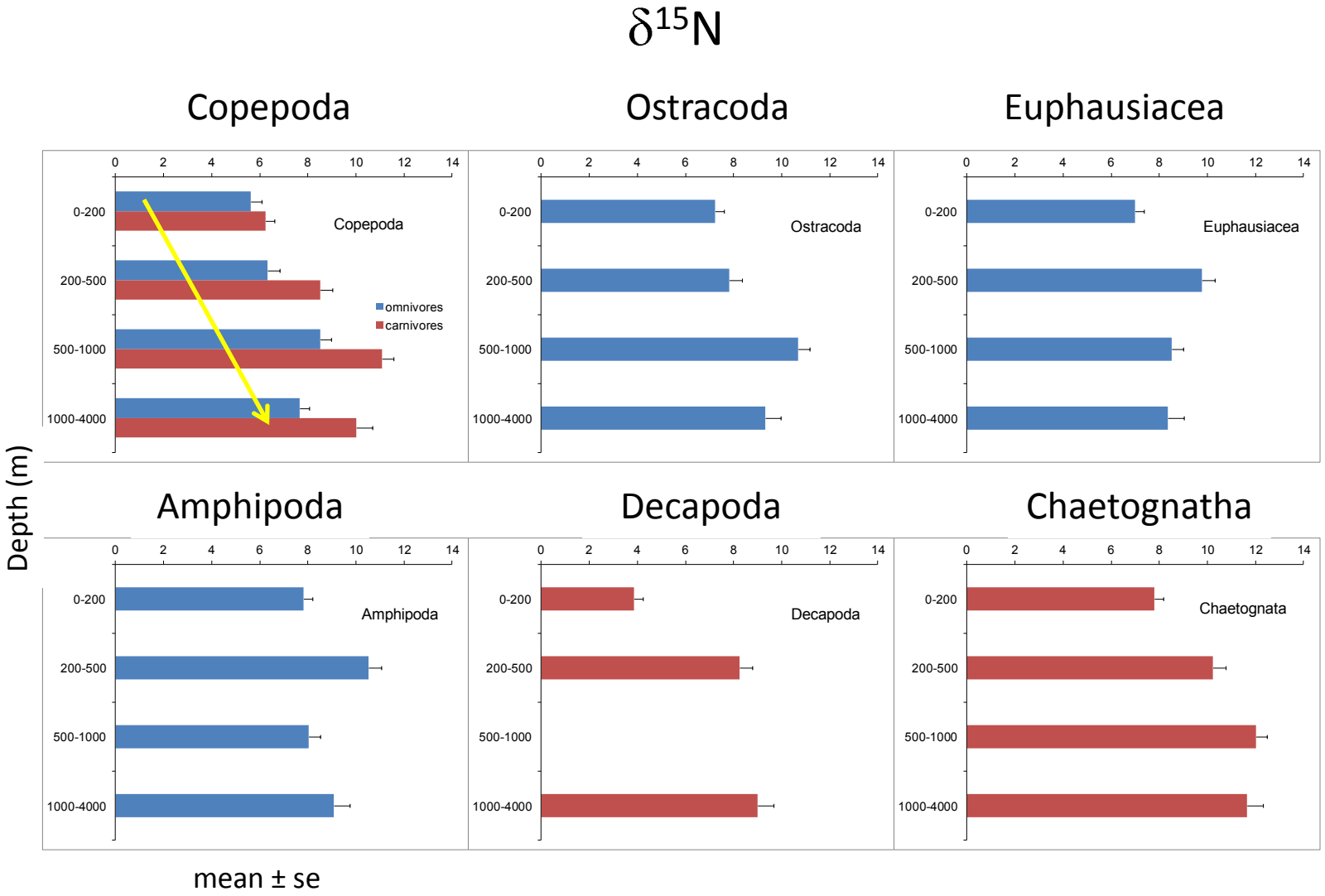
The trophic ladder:



mean ± se

Results

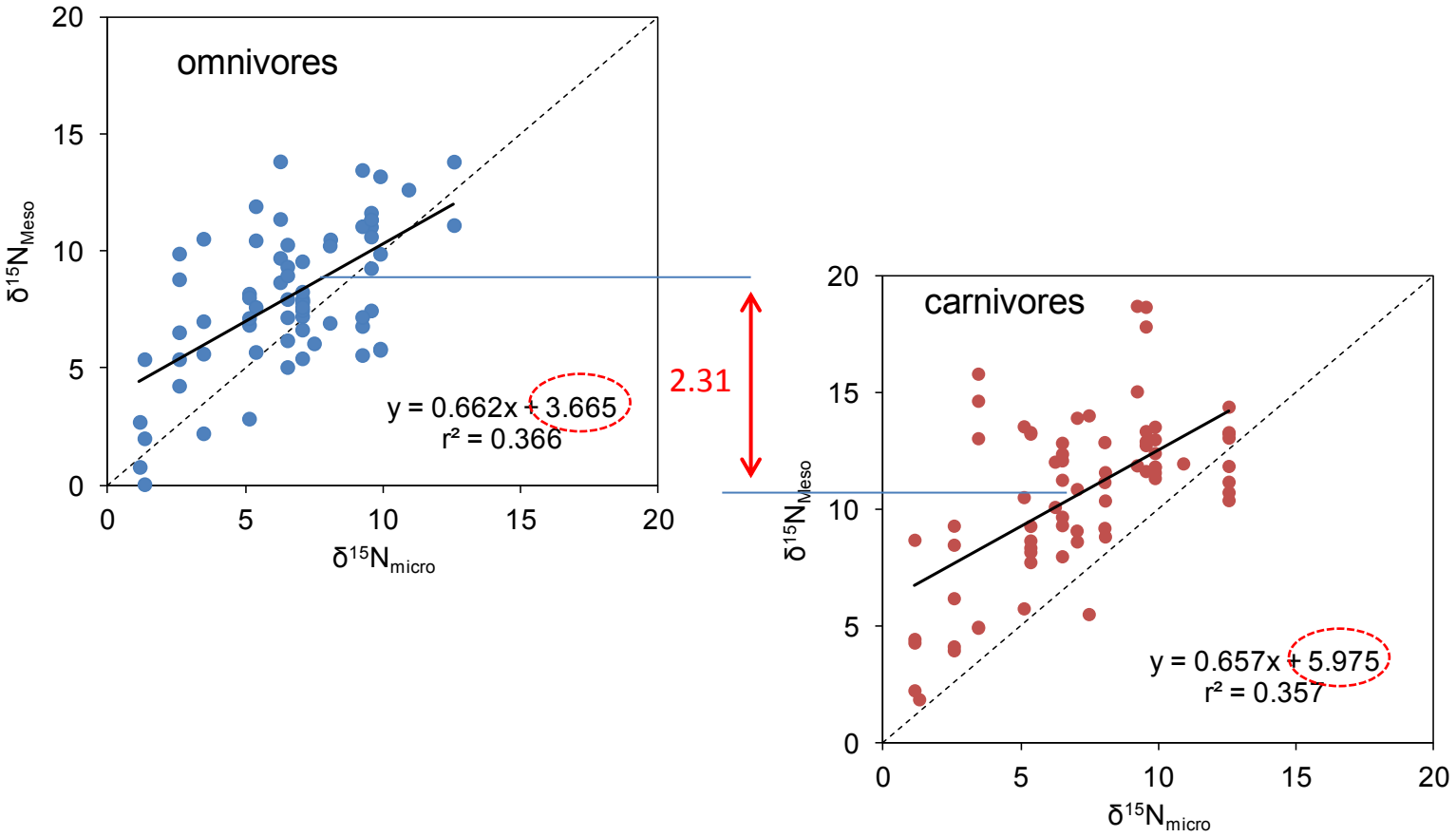
The trophic ladder by groups



Results

$\delta^{15}N$ at depth mirrors surface sources

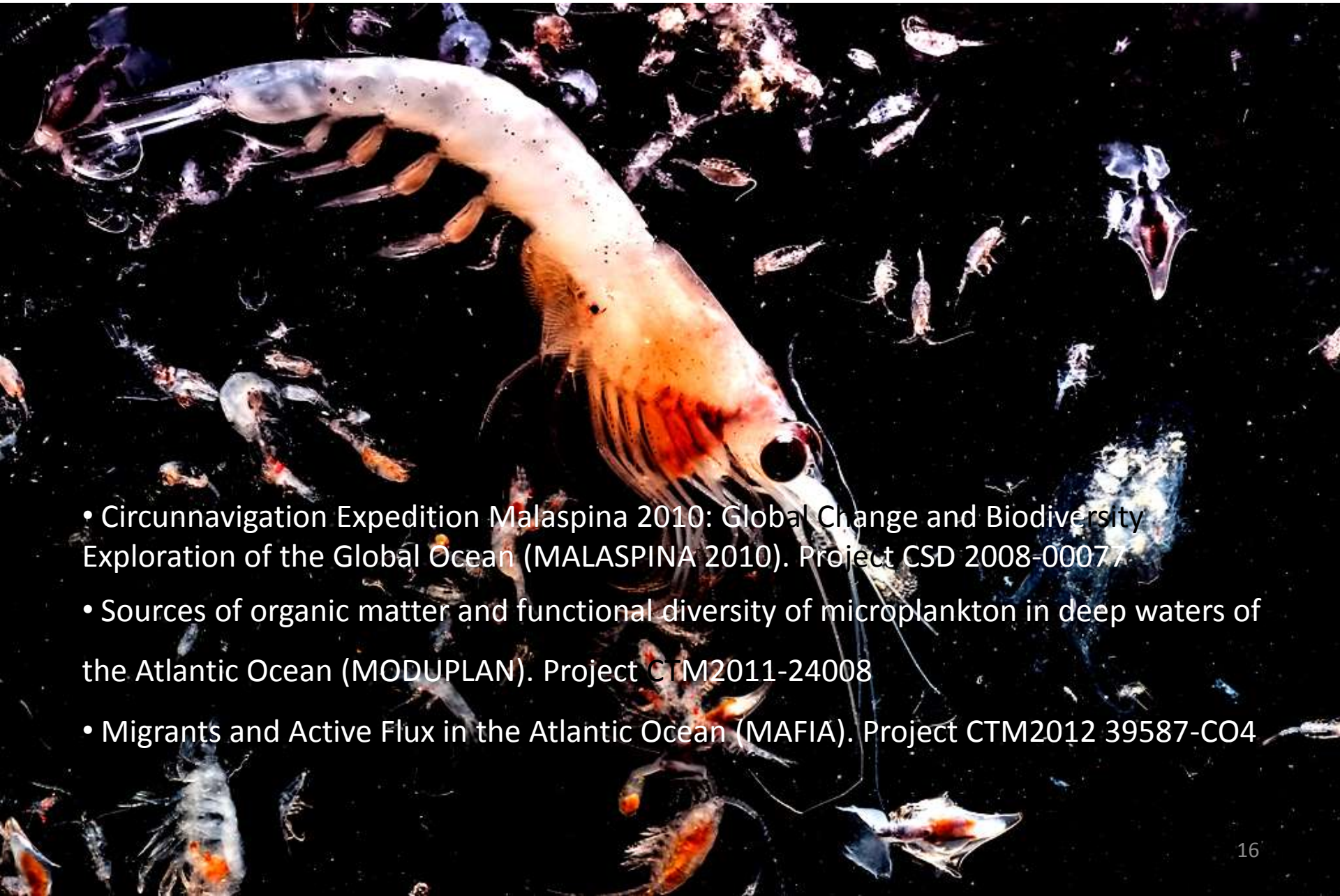
Meso- & bathypelagic layers



Conclusions

- Ocean autotrophy: no large influence of coastal production ($\delta^{13}C$)
- Surface production sustains deep consumers at all layers ($\delta^{15}N$)
- Meso- and bathypelagic layers display similar trophic structure
- Top predators: Siphonofora, Chaetognata and Myctophidae
- Lowest TL: Calanoid Copepods and Mysidacea
- Copepods: model for the trophic ladder

Funding:



• Circunnavigation Expedition Malaspina 2010: Global Change and Biodiversity Exploration of the Global Ocean (MALASPINA 2010). Project CSD 2008-00077

• Sources of organic matter and functional diversity of microplankton in deep waters of the Atlantic Ocean (MODUPLAN). Project CTM2011-24008

• Migrants and Active Flux in the Atlantic Ocean (MAFIA). Project CTM2012 39587-CO4